PhytoKeys 206: 129–136 (2022)
doi: 10.3897/phytokeys.206.87737
https://phytokeys.pensoft.net

RESEARCH ARTICLE

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PhytoKeys
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Resurrection of *Drypetes nienkui* (Putranjivaceae), endemic to Hainan, China

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Academic editor: Alexander Sennikov | Received 13 June 2022 | Accepted 27 August 2022 | Published 12 September 2022

Citation: Levin GA (2022) Resurrection of *Drypetes nienkui* (Putranjivaceae), endemic to Hainan, China. PhytoKeys 206: 129–136. https://doi.org/10.3897/phytokeys.206.87737

Abstract

Drypetes nienkui (Putranjivaceae), described from Hainan, China, has long been treated as a synonym of *D. indica*. Both species belong to a distinctive group of Asian species characterized by perulate buds that give rise to shoots bearing flowers or inflorescences proximally and leaves distally, 2–3-carpellate ovaries, and elongate styles. However, *D. nienkui* fundamentally differs from *D. indica* in inflorescence architecture and fruiting pedicel length; these or other characters also distinguish *D. nienkui* from the remaining species in this group. *Drypetes nienkui* therefore deserves recognition as a distinct species endemic to Hainan. An expanded description of the species is provided along with a key to the related species.

Keywords

Asia, China, *Drypetes*, Hainan, Putranjivaceae

Introduction

The genus *Drypetes* Vahl (Putranjivaceae Endl., Malpighiales) comprises about 220 species of mostly dioecious trees and shrubs found in the tropics and subtropics worldwide; it is most diverse in Asia, with about 120 species. Thirteen species currently are recognized from China (Qin et al. 2007; Li and Gilbert 2008); of these, nine are reported from Hainan, including the endemic *D. longistipitata* P.T.Li. Among the currently accepted species found in China, there are two, *D. indica* (Müll. Arg.) Pax & K.Hoffm., and *D. longistipitata*, that, along with the Thailand endemic

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D. dasycarpa (Airy Shaw) Phuph. & Chayamarit, belong to a group of taxa that are distinctive among Asian *Drypetes* in having prominent buds enclosed in chartaceous scales (perules; Fig. 1A). When the axillary, and sometimes the terminal, buds develop into shoots, the proximal few nodes usually are leafless and produce flowers or inflorescences, while the more distal nodes produce leaves (Fig. 1A). In addition, the pistils, which are 2–3-carpellate, have more or less elongate styles that bear peltate to flabellate stigmas (Fig. 1B); most other *Drypetes* species in the region have 1-carpellate pistils, sessile stigmas, or both. This group of species, which I will refer to as the *D. indica* complex, ranges from Bhutan and northeastern India eastward to Taiwan and southward to Thailand.

Taxonomic concepts within the *Drypetes indica* complex have varied widely. For example, Pax and Hoffmann (1922), the last to review *Drypetes* worldwide, accepted *D. indica* and four other species that I would place in this complex: *D. griffithii* (Hook.f.) Pax & K.Hoffm., *D. hieranensis* (Hayata) Pax & K.Hoffm., *D. karapinensis* (Hayata) Pax & K.Hoffm., and *D. lancifolia* (Hook.f.) Pax & K.Hoffm.. In contrast, Airy Shaw (1972), in a review of Euphorbiaceae s.l. in Thailand, synonymized the latter four species under *D. indica*. He also treated *D. nienkui* Merr. & Chun, a species described from Hainan, China, as a synonym of *D. indica*. He noted that this treatment made for a highly variable species, but felt that specimens from Thailand and Hainan bridged the morphological and geographic gaps between Indian/Burman material and that from Taiwan. Li (1988) expanded Airy Shaw's broad concept of *D. indica* to include *D. longipes* X.H.Song, and this view has been followed in treatments of the genus for China (Li 1988, 1994; Li and Gilbert 2008; Fang et al. 2011). However, Taiwanese botanists have continued to treat the material from there as distinct from *D. indica*, recognizing either both *D. hieranensis* and *D. karapinensis* (Hsieh 1977) or, more recently, synonymizing *D. hieranensis* under *D. karapinensis* (Lu 1986; Hsieh et al. 1993; Boufford et al. 2003). Both *D. dasycarpa* and *D. longistipitata* were described after Airy Shaw (1972) expanded the concept of *D. indica* and have consistently been accepted as distinct taxa, although Airy Shaw (1977) initially described *D. dasycarpa* as a variety of *D. indica*.

Drypetes nienkui was described from a single fruiting specimen (Merrill and Chun 1935). Because an isotype from this gathering is the only specimen of *D. nienkui* at K (pers. obs. and GBIF 2022) and I have seen no other specimens of this species annotated by Airy Shaw, it appears that he (Airy Shaw 1972) only saw this specimen before synonymizing *D. nienkui* under *D. indica*. Having had the opportunity to examine more specimens, including type material, of *D. nienkui* and the other species in the *D. indica* complex from throughout eastern Asia, I believe the broad treatment of *D. indica* pioneered by Airy Shaw (1972) is too inclusive. *Drypetes nienkui*, in particular, is quite distinct, although further species may also deserve recognition. Here I review morphological characters that distinguish *D. nienkui* from *D. indica* and *D. dasycarpa*; I also provide an expanded description of *D. nienkui* and a key to species I currently accept in the *D. indica* complex.

Materials and methods

Morphological characters were examined on specimens held by A, BM, G, IBSC, K, KUN, L, NY, P, and US (herbarium acronyms follow Thiers [continuously updated]), and online images of specimens from AU, CAS, E, HITBC, IBK, MW, NAS, PE, SN, TAI, TI, and TNM available at JSTOR Global Plants (https://plants.jstor.org/), the Chinese Virtual Herbarium (http://www.cvh.ac.cn/), the Global Biodiversity Information Facility (https://www.gbif.org/), and individual herbarium websites. Measurements were made using both actual specimens and specimen images containing scale bars.

Results and discussion

Material that Airy Shaw (1972) and others included within *Drypetes indica* exhibits two different inflorescence variants. Specimens from Hainan that have been called *D. indica* or *D. nienkui* have staminate and pistillate flowers borne in cymose inflorescences and pistillate pedicels that are no longer than 12 mm in fruit (Fig. 1C), whereas all the remaining specimens of *D. indica* in the broad sense have fasciculate staminate flowers and solitary pistillate flowers, the pedicels of which become at least 16 mm long in fruit (Fig. 1B); the same is true of *D. longistipitata*. Merrill and Chun (1935) described the infructescences of *D. nienkui* as "depauperate-racemose" (they had only fruiting material), although they actually are cymose. *Drypetes dasycarpa* also has cymose inflorescences and relatively short pistillate pedicels, as was reported by Phuphathanaphong and Chayamarit (2000, 2005). These inflorescence characters were overlooked by Airy Shaw (1972, 1977), perhaps because the specimens of *D. dasycarpa* and *D. nienkui* that he studied at Kew have either only detached fruits or infructescences bearing only a single mature fruit (pers. obs.).

Within the cymose inflorescence group, the specimens sort neatly into two groups based on differences in pubescence, perule size, leaf blade size, staminate pedicel length, and stamen number. The groups correspond to plants from northern and western Thailand (*Drypetes dasycarpa*) and those from Hainan (*D. nienkui*). Within the group with fasciculate staminate flowers and solitary pistillate flowers, it appears that *D. indica* and *D. longistipitata* are distinct, based on differences in leaf blade secondary vein number and prominence, pistillate pedicel length, style length, and drupe size. Specimens of the *D. indica* complex from Taiwan, which have been treated as *D. karapinensis* (of which *D. hieranensis* should be treated as a synonym), differ somewhat from mainland Asian *D. indica* in pubescence, leaf vein number, stamen number, and fruiting pedicel length, but the differences are subtle and overlapping; resolving their taxonomic status is beyond the scope of this paper, and here I treat them both within a broadly defined *D. indica*. Differences among species in the *D. indica* complex are summarized in the key below.

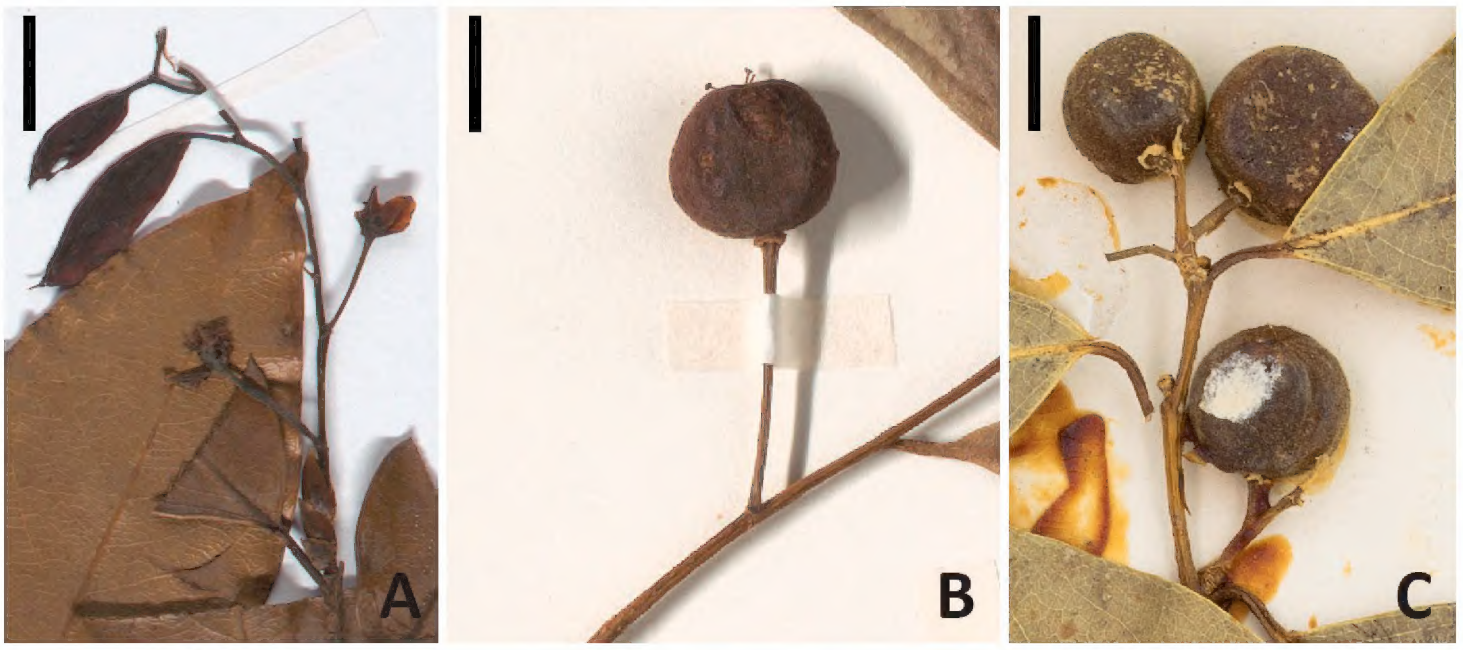

Figure 1. Morphology of the *Drypetes indica* complex **A** *D. indica* (detail of L.2207751), branch tip showing perulate bud below an expanding shoot with proximal flowers and distal leaves **B** *D. indica* (detail of L.2207743) fruit with elongate styles bearing flabellate stigmas **C** *D. nienkui* (detail of NY02684347, holotype) with two cymose infructescences. Scale bars equal 1 cm. Photos **A, B** CC 1.0 Naturalis Biodiversity Center **C** CC 4.0 New York Botanical Garden.

Taxonomic treatment

Drypetes nienkui **Merr. & Chun, Sunyatsenia 2: 258, fig. 29C, D. 1935.**

Type. China. Hainan: Fan Ya, Ng Chi Ling, elev. 1200 m, 8 Nov 1932, *N. K. Chun & C. L. Tso 44246* (holotype: NY02684347!; isotypes A00055929!, AU042776! (image seen), IBSC0004245!, IBSC0004246!, IBSC0004247!, K000854225!, NAS00417232! (image seen), PE00022638! (image seen), US01269000!).

Description. Trees to 15(–20) m, to 30 dbh, dioecious; branches and branchlets glabrous. **Buds** perulate; perules ovate, 1.5–2 × 1.6–2 mm, apex obtuse to rounded, surfaces glabrous, margins ciliolate. **Leaves:** stipules caducous, not seen; petiole 8–13 mm long, 1.3–1.7 mm diam., canaliculate, glabrous; blade oblong-ovate to oblong-lanceolate, 8–14 × 3–6 cm, chartaceous-coriaceous, base ± asymmetric, broadly cuneate to broadly acute, margins entire, apex acute to gradually short-acuminate, tip obtuse, surfaces glabrous, abaxial light green, somewhat shiny, adaxial olive, shiny; midvein rounded abaxially and adaxially, 2° veins 6–9 per side, slender but not obscure, 3° reticulate, higher order not well differentiated, reticulate, all raised adaxially, areoles 0.6–1 mm diam., freely ending veinlets fairly common. **Staminate inflorescences** cymose, to 2 cm long, 8–10-flowered; peduncle 0.5–0.8 mm diam., glabrous; bracteoles triangular, 0.8–1 mm long, surfaces glabrous, margins ciliate. **Pistillate inflorescences** cymose, 1 cm long (fruiting), 4–7-flowered; peduncle 1.5–1.7 mm diam. (fruiting), glabrous; bracteoles not seen. **Staminate flowers:** pedicels 2–5 mm long, 0.3 mm diam., puberulent; sepals 4, ovate, 1.7–2 × 1.2–1.5 mm, apex rounded, surfaces glabrous, margins ciliate; disc shallowly lobed, glabrous; stamens 8, inserted between disc lobes, filaments 1.5 mm long, terete, glabrous, anthers +/- globose, 0.5 mm

diam., glabrous. **Pistillate flowers** not seen; fruiting pedicels 6–12 mm long, 1.4–1.7 mm diam., puberulent, glabrescent, hairs erect, to 0.1 mm long; ovaries densely hirsute when young. **Drupes** purplish brown, globose or depressed globose, sometimes slightly lobed, 15–18 mm diam., 2–3-locular, surface sparsely hirsute, trichomes whitish, 0.1–0.2 mm long, erect; styles 2–3, 1.5–2 mm long; stigmas +/- flabellate, 0.5 × 0.7 mm; exocarp and mesocarp not differentiated, 0.5 mm thick, leathery or crustaceous, endocarp 0.1 mm thick, cartilaginous. **Seeds** 2–3.

Phenology. *Drypetes nienkui* flowers August-November and fruits November–January.

Distribution and habitat. *Drypetes nienkui* is widespread in the southern half of Hainan, China (see the map for *D. indica* in Fang et al. [2011], as to Hainan only), occurring in forests at 950–2100 m elevation.

Preliminary conservation status. I have been able to locate only 13 gatherings of *Drypetes nienkui*. With the exception of two collections made in 2014 and 2017, all the collections date from between 1932 and 1954, but no data are available regarding population sizes or trends. Applying the criteria of IUCN (2022), *D. nienkui* should receive a preliminary conservation assessment of Data Deficient, although a more complete assessment might show it qualifies as a species of elevated conservation concern.

Key to species in the *Drypetes indica* complex

1 Pistillate and staminate inflorescences cymose; fruiting pedicels 5–12 mm long **2**

– Pistillate flowers solitary, staminate inflorescences fascicles (unknown in *D. longistipitata*); fruiting pedicels 16–40 mm long **3**

2 Young stems and petioles hairy; perules 5–7 mm long, densely hairy; leaf blades 10–18 cm long; staminate flowers: pedicels 5–10 mm long, disc hairy, stamens 8–12 ..... ***Drypetes dasycarpa***

– Young stems and petioles glabrous; perules 1.5–2 mm long, glabrous except for ciliate margins; leaf blades 8–14 cm long; staminate flowers: pedicels 3–5 mm long, disc glabrous, stamens 8 ..... ***Drypetes nienkui***

3 Leaf blade secondary veins 5–8 pairs, prominent; fruiting pedicels 20–40 mm long; styles 1.5–3 mm long; drupes 12–16 mm diam ..... ***Drypetes indica s.l.* (including *D. karapinensis*)**

– Leaf blade secondary veins 4–5(–6) pairs, delicate; fruiting pedicels 16–20 mm long; styles 1 mm long; drupes 10–12 mm diam ..... ***Drypetes longistipitata***

Acknowledgements

My thanks to the curators and staff at the cited herbaria for making their specimens available for me to study in person or through loans or online images, and especially to Peter van Welzen (L), Xia Nianhe (IBSC), and Xiang Chunlie (KUN) for hosting my

visits to their institutions. I am grateful to the Naturalis Biodiversity Center for awarding me a Temminck Fellowship, which allowed intensive study of specimens in L. Lynn Gillespie made helpful comments on a draft of the manuscript, and the editor and an anonymous reviewer provided valuable comments and suggestions.

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Appendix 1

Specimens examined for comparative morphological studies of the *Drypetes indica* complex. Listed are country, primary collector name and collection number, date of collection, herbarium, and, when available, barcodes (enclosed in square brackets when they do not include the herbarium acronym) or accession numbers (identified by "acc. #"). Specimens that I observed only through online images are marked with an asterisk (*).

***Drypetes nienkui*:** China. *N. K. Chun 44246*, 8-Nov-1932, A00055929, AU042776*, IBSC0004245, IBSC0004246, IBSC0004247, K000854225, NAS00417232*, NY02684347, PE00022638*, US01269000; *Chun W. Y. 420*, 26-Nov-1936, IBSC0311573; *Hainan East Road team 610*, 9-Nov-1954, IBK00165777*, IBSC0311570; *Hainan East Road team 960*, 19-Dec-1954, IBK00165780*, IBK00165784*, IBSC0311574; *Hainan hanging mountain team 2988*, 19-Dec-1954, IBK00165775*, IBSC0311575; *How F. C. 73525*, 29-Aug-1935, AU012778*, IBK00165774*, IBK00165781*, IBSC0311578, NAS00412112*; *How F. C. 73673*, 15-Sep-1935, IBK00165782*, IBSC0311579; *Liu C. 17CX15977*, 10-Sep-2017, KUN1445422*; *Wang C. 35261*, 9-Dec-1933, IBK00165776*, IBSC0311572, NAS00412111*, NY; *Wang C. 36145*, 6-Jan-1934, IBK00165779*, IBSC0311576; *Wang C. 36238*, 9-Jan-1934, IBSC0311577; *Wang C. 36622*, 13-Jan-1934, IBK00165778*, IBSC0311571, SN007954*, NY; *Zhang T. 14CS8905*, 19-Aug-2014, KUN1371389.

***Drypetes dasycarpa*:** Thailand. *N. Fukuoka T-62161*, 14-Jan-1994, L.2207742; *H. B. G. Garrett* 593, 6-Nov-1930, BM, P05470830*; *A. F. G. Kerr 4919*, 26-Feb-1921, P05563357; *A. F. G. Kerr 5047*, 8-Mar-1921, BM; *H. P. Nooteboom 807*, 21-Jan-1969, K000854258, L.2207753; *T. Yahara T-50009*, 10-Dec-1984, L.2207754.

***Drypetes indica s.l.* (including *D. karpapinensis*):** Bhutan. *A. J. C. Grierson 1694*, 6-Jun-1979, E00310566*. China. *Li Y.-H. 12533*, 28-Jun-1974, HITBC Acc. # 014370*, 081461*. India. *W. Griffith 4738*, K000246683; *J. D. Hooker s.n.*, E00310592*, G00318470, G00318473, K000246684, K000246685, K000246686,

K000246687, L.2207755, L.2208087, L.2208088, P05470767, P05470831, P05470832, P05470835, P05470836, P05470837, P05470838. Taiwan. *C.-H. Chen 505*, 1-Apr-1994, TNM [S14022*, S34201*]; *S. T. Chiu 1657*, 31-Mar-1993, TNM [S10365*, S10367*]; *T. I. Chuang 3117*, 10-Jan-1960, TAI Acc. # 067424*, Acc. # 067425*; *S.-W. Chung 5062*, 26-Feb-2002, TNM [S79934*]; *S.-W. Chung 5072*, 26-Feb-2002, TNM [S79933*]; *S.-W. Chung 5073*, 26-Feb-2002, TNM [S79935*]; *Hayata 45*, 23-Apr-1914, A00055901, IBSC0311581, TAI Acc. #01604*, Acc. # 01605*; *H.-Y. Chen 151*, 8-Mar-1998, TNM [S77423*]; *H.-Y. Chen 163*, 8-Mar-1998, TAI Acc. # 251490*; *G.-P. Hsiah 1383*, 1-May-2004, TNM [S108917*]; *Y.-Y. Huang, 327*, 29-Apr-2021, CAS669031*; *V.-P. Leu s.n.*, 6-Apr-1939, TNM [S3042*]; *S.-P. Li 435*, 2-Mar-1995, IBSC0311582, TNM [S172508]; *S.-Y. Lu 256*, 2-Apr-1993, TAI Acc. # 225015*; *S.-Y. Lu 18279*, 6-Feb-1986, L.2207711, MW0756562*, MW0756562*; *S.-Y. Lu 18606*, 11-Mar-1986, L.3799848; *S.-Y. Lu 18613*, 13-Dec-1982, L.2207709; *Ou 9452*, 31-May-1980, TAI Acc. #178887, Acc. # 178895; *S. Sasaki s.n.*, Feb 1912, TI Acc. #01603*; *C. M. Wang 2126*, 25-Feb-1996, CAS669034*; *J.-C. Wang 8177*, 24-Apr-1993, TAI Acc. # 255401; *L. J. Wang s.n.*, 19-Mar-1966, TAI Acc. # 067420*, Acc. # 067421*; *S. Z. Yang 10703*, 10-Apr-1988, IBSC0311565; *S. Z. Yang 10761*, 19-Mar-1989, IBSC0311564; *T. Y. A Yang 23063*, 27-Feb-1997, TNM [S31964*]. Thailand, *A. F. G. Kerr 12049*, 12-Feb-1927, BM, L.2207741, P05470829; *A. F. G. Kerr 16780*, 21-Jan-1929, BM, L.2207744; *A. F. G. Kerr 17181*, 22-Feb-1929, BM, P.05563358; *A. F. G. Kerr 17184*, 22-Feb-1929, BM, P05563356; *A. F. G. Kerr 17991*, 7-Jan-1930, L.2207749; *A. F. G. Kerr 18004*, 7-Jan-1930, BM, L.2207748; *A. F. G. Kerr 18442*, 8-Mar-1930, L.2207747; *A. F. G. Kerr 18448*, 5-Mar-1930, BM; *A. F. G. Kerr 18448A*, 9-Mar-1930, BM, L.2207745, P05563359.

***Drypetes longistipitata*:** China. *How F. C. 70367*, 17-Mar-1933, IBK00165773*; *Wei C. F. 122372*, 24-Apr-1959, IBSC0311561; *Xing Z. W. 6196*, 16-May-1995, IBSC0311562, IBSC0311563.